

Chapter 10

Medical Management of Childhood Lead Poisoning

Contents:

Summary Recommendations for Medical Management of Childhood Lead Poisoning

Introduction

Using Information from Public Health Agencies

Anticipatory Guidance for Families

Perform Routine Blood Lead Screening

Lead Education for the Family

Provide Diagnostic and Follow-up Testing

Clinical management of Lead Poisoned Children

Assure Follow-Up

Collaborate with Public Health Agencies

Summary Recommendations for Medical Management of Childhood Lead Poisoning*

| Blood Lead Level (BLL) | | | |
|---|---|--|--|
| 10-19 (µg/dL) | 20-44 (µg/dL) or 2 BLLs ≥15 µg/dL drawn at least 90 days apart | 46-69 (µg/dL) | ≥70 (µg/dL) |
| <ul style="list-style-type: none"> Lead education <ul style="list-style-type: none"> - Dietary - Environmental - Child development Follow-up blood lead monitoring | <ul style="list-style-type: none"> Lead education <ul style="list-style-type: none"> - Dietary - Environmental - Child development Follow-up blood lead monitoring Clinical evaluation Lab work: <ul style="list-style-type: none"> - Hemoglobin or hematocrit - Iron status - EP Environmental investigation with lead hazard reduction Neurodevelopmental monitoring Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated. | <ul style="list-style-type: none"> Lead education <ul style="list-style-type: none"> - Dietary - Environmental - Child development Follow-up blood lead monitoring Clinical Evaluation Lab work: <ul style="list-style-type: none"> - Hemoglobin or hematocrit - Iron status - EP Environmental investigation with lead hazard reduction Neurodevelopmental monitoring Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated. Chelation therapy | <ul style="list-style-type: none"> Hospitalize and start chelation therapy Lead education <ul style="list-style-type: none"> - Dietary - Environmental - Child development Follow-up blood lead monitoring Clinical Evaluation Lab work: <ul style="list-style-type: none"> - Hemoglobin or hematocrit - Iron status - EP Environmental investigation with lead hazard reduction Neurodevelopmental monitoring Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated. |
| <p>The following actions are NOT recommended at any blood lead level:</p> <ul style="list-style-type: none"> Searching for gingival lead lines Testing of neurophysiologic function Evaluation of renal function (except if receiving EDTA) Testing hair, teeth or fingernails for lead Radiographic imaging of long bones X-ray fluorescence of long bones | | | |

*Adapted from "Managing Elevated Blood Lead Levels Among Young Children", Center for Disease Control and Prevention, March, 2002

Introduction

Medical management of lead poisoning in children begins with assessment and screening of children ages 6 months through 5 years. Primary prevention of lead poisoning starts in the pediatrician's office, where information on lead hazards and basic prevention strategies is presented along with other health and safety information such as cabinet locks and car seat use. The first step in medical management is for clinical assessment of the risk for lead exposure to happen at well child visits. Once a child is identified at risk of lead poisoning, early detection is provided by physicians through blood lead tests.

If a diagnosis of lead poisoning is made, the physician joins with the family, public health and the property owner to treat the disease. Public health assures that case management and environmental investigation occur for the child and family. The property owner is responsible for eliminating the lead hazards identified as causing the child's lead poisoning. The physician provides ongoing assessment through age-appropriate physical exams, venous follow-up tests, chelation therapy if appropriate, and long-term monitoring for the development of cognitive, learning and behavioral deficits. The family must be diligent in implementing steps to prevent exposure and decrease toxicity.

Eight roles of child health care providers in lead poisoning prevention and treatment are listed in the CDC publication "*Screening Young Children for Lead Poisoning*" (<http://www.cdc.gov/nceh/lead/lead.htm>, click on publications). These roles are:

1. Use and disseminate information from state and local public health agencies
2. Give anticipatory guidance to parents of young children
3. Perform routine blood lead screening, as recommended
4. Provide lead education to the family
5. Provide diagnostic and follow-up testing for children with elevated blood lead levels
6. Provide clinical management
7. Participate in a follow-up team
8. Collaborate with public health agencies

These roles are described further on the following pages. In many cases, with the most experience and knowledge about lead poisoning; the leadership role in working with physicians to protect children from lead poisoning is taken by public health professionals.

Using Information from Public Health Agencies

Public health agencies can provide health care providers with information about:

- ✓ Key points for families to know to protect their child(ren) from lead poisoning
- ✓ Follow-up care and interventions provided by the health department
- ✓ Resources for information on current pediatric practice standards and professional consultation related to CLP
- ✓ Resources within the community that can assist families with a diagnosis of lead poisoning

- ✓ Resource within the community that can assist the family with lead hazard reduction.

It is important that local physicians know the protocols and policies of the local LHD in following a child with lead poisoning. One barrier identified by physicians to screening has been the belief that nothing can be done unless the child is given chelation. A change in screening practices by local health care providers may result if they become aware of the public health interventions for all children who are lead poisoned, specifically what happens at each blood lead level.

WCLPPP strongly recommends that local health departments communicate with the physician about all public health interventions provided to children with BLLs $\geq 10\mu\text{g/dL}$. At lower BLLs this communication may be done through a form letter; for higher BLLs phone contact with the physician is most appropriate. In addition, a summary of public health assessments, findings, observations, and interventions for the child and family should be shared with the primary health care provider. Contact with the physician allows him/her to keep informed of the activities that are contributing to the child's recovery, and allows the public health provider to request copies of lab tests (such as iron deficiency studies or erythrocyte protoporphyrin levels) and physician assessments. This communication also increases the physician's awareness of the role of public health. A model of a form that can be utilized for such communication can be found at the end of this chapter.

Services available in the community to assist the family in managing or preventing lead poisoning is important information for physicians so they can refer their patients appropriately. Public health professionals are often the most knowledgeable about community resources, especially those available to low income families. A referral directly to public health of a family whose assessment indicates risk for lead exposure, or a blood lead test reveals lead poisoning will help to assure that the family is made aware of, receives, or is referred for needed services.

Anticipatory Guidance for Families

During prenatal visits, and with pediatric preventive care for infants <12 months of age, it is recommended that physicians include information about the hazards of deteriorating lead-based paint in older housing, the hazards associated with repainting and renovation of homes built prior to 1978, and other exposure sources that may be particular to a family (such as occupational exposure or traditional remedies).

It is important that this information is presented at multiple and specific times in a child's development. Increased awareness on the part of parents at these times may prevent lead exposure that could result in lead poisoning. The risk of exposure increases as the child develops, becomes more mobile in his/her environment, and engages in more hand-to-mouth behavior. When children are ages 12 and 24 months, anticipatory guidance can be linked to asking the "4 Easy Questions" for areas where targeted screening is recommended.

Specific suggestions for age-specific anticipatory guidance to protect children from lead exposure can be found in Table 10.1

Table 10.1
Normal Child Developmental Activities & Actions to Prevent Lead Exposure

| AGE | TYPICAL BEHAVIOR | ACTIONS TO PREVENT INGESTION OF LEAD DUST OR PAINT |
|--------------|--|---|
| 0-8 months | Plays in crib for periods of time Plays with hands. Picks up small objects. Begins putting objects into mouth Teething begins Chewing increases | ✓ Test crib paint or varnish for lead and keep lead hazards out of reach ✓ Frequently wash all items that are “mouthable”: toys, teething rings, pacifiers, cups, bottles, etc. ✓ Wash hands and face before eating, napping, and after play |
| 9-12 months | Finger feeds Ready to go places on his/her own Developing motor capacities, crawling Has emerging desire to look at, handle & touch objects Explores objects by sucking, chewing, and biting | ✓ Keep finger nails cut short ✓ Provide healthy foods on a regular schedule ✓ Include iron-fortified cereal/foods in diet ✓ Make sure floors, stairs, window sills & wells are cleanable & as dust free as possible |
| 13-18 months | Walks upstairs with help Creeps downstairs Self-feeder May refuse food Appetite may decrease | ✓ Provide lead-free age-appropriate play objects & toys ✓ Supervise the child's activities so access to lead hazards is monitored ✓ Provide lead-safe indoor play areas for exploring & practicing motor skills |
| 19-30 months | Longer play periods Likes manipulative & construction toys Explores his/her environment Runs Walks up & down stairs independently Distinguishes food and non-food items | ✓ Provide lead-safe outdoor play areas (no lead-contaminated soil or lead-painted play equipment) ✓ Use safety gate at top and bottom of stairs to prevent unsupervised access ✓ Encourage use of spoon and cup ✓ Reinforce identification of non-food items |
| 31-46 months | Dramatizes, expresses imagination at play Washes and dries own hands | ✓ Observe for signs of pica ✓ Child may ingest paint chips pretending they are food |
| 47-52 months | Fond of cutting and pasting creative materials Displays greater independence in general activities | ✓ Reinforce independent handwashing ✓ Provide lead-safe art supplies ✓ As independence increases, continue to supervise activities so that access to lead hazards is monitored |
| 53-72 months | Definite likes and dislikes in food Less time spent with family Engages in play with others Skillful in climbing, sliding and swinging Plans and builds with simple tools. | |

Physicians can be advised that patient education materials for their offices and waiting rooms are available through the Department of Health and Family Services. Check the Department Web site for publications by the WCLPPP and for links to the Alliance to End Childhood Lead Poisoning which produces many publications that can be ordered. (www.dhfs.state.wi.us/dph_beh/env_health_resources/lead/lead_issues.htm)

Routine Blood Lead Screening

The Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP), at the direction of the Centers for Disease Control and Prevention (CDC), formed an advisory group with representatives from the fields of medicine, managed health care, public health, and the Wisconsin Medicaid program. The group met in 1997, and used Wisconsin blood lead screening data and CDC guidelines to develop recommendations for screening Wisconsin children for lead poisoning. The Wisconsin Childhood Blood Lead Screening Recommendations should be used by all physicians in Wisconsin caring for children, with a more aggressive set of guidelines for physicians caring for children residing in the cities of Milwaukee and Racine (see Figure 10.2). Details of the Wisconsin Blood Lead Screening Recommendations can be found in Chapter 7.

The current practice standard for screening for lead poisoning and follow-up for children with elevated blood lead levels is important for physicians to know so it can be incorporated into routine preventive pediatric practice. The American Association of Pediatrics is an excellent and respected source for this information (<http://www.aap.org/policy/re9815.html>).

As part of their assurance role, public health, agencies are responsible for assuring that blood lead testing is available to high risk populations. One way of doing this is by informing local health care providers aware of local risks factors, local screening recommendations and local screening practices. Provider specific information that reflects how many children an individual provider tests, and the prevalence of lead poisoning among their clientele, can be a useful tool when discussing a specific provider's screening practices.

Lead Education for the Family

Physicians must be made aware that even at the lowest blood lead levels, there is action they can take to prevent an increase in the severity of lead poisoning. It is parents who provide the child with supervision and a safe environment to live in. Education to increase parental awareness of potential dangers, and simple steps they can take to protect their children is one of the strongest components of medical management.

Any child with a BLL $\geq 10\mu\text{g/dL}$ should receive prompt and individualized education from their health care provider about what the BLL is and what it means, potential adverse health effects of lead poisoning, the need for long term follow-up, and possible sources

Figure 10.2 BLOOD LEAD SCREENING & DIAGNOSTIC TEST SCHEDULES

| | |
|--|--|
| Targeted Screening Policy | <p>Assess risk for lead exposure using the 4 Easy questions* at each well-child visit ages 6 months through 5 years. Do a blood lead test if any answer indicates risk of lead exposure.</p> <p>Test all children on Medicaid at age 1 and 2 years, and if 3-5 years without a documented test</p> <p>*Does the child live in or frequent a building built before 1950? Does the child live in or frequent a building built before 1978 with recent or ongoing renovation? Does the child have a sibling or playmate who has/had lead poisoning? Is the child enrolled in Medicaid or WIC?</p> |
| Universal Screening Policy | <p>Each child receives blood lead test at age 1 and 2 yrs</p> <p>Each child age 3-5 years is tested if a blood lead test is not documented</p> <p>A child residing in the city of Milwaukee or Racine is tested at ages 12, 18, and 24 months</p> <p>A child residing in the city of Milwaukee or Racine, is enrolled in Medicaid, WIC or uninsured, is test annually from age 3-5 years.</p> |
| Venous or Capillary Blood Lead Test Drawn | |
| Test result is <10µg/dL: Further actions depend on the age of the child, city of residence, and if enrolled in Medicaid or WIC | <p>Child is 1year: Retest at age 2; retest at 18 & 24 months if resident of city of Milwaukee or Racine</p> <p>Child is 2 years: No further testing required</p> <p>Child is 3, 4 or 5 years & lives outside of Milwaukee & Racine: No further testing is required</p> <p>Child is 3, 4, or 5 years, lives in Milwaukee or Racine, & is enrolled in Medicaid, WIC or uninsured: test annually</p> |
| Elevated screening capillary tests require a venous diagnostic tests. | <p><u>If capillary screening test result is, obtain a venous diagnostic test in:</u></p> <p>10-19µg/dL, in 3 months</p> <p>20-44µg/dL, in 1 week to 1 month depending on level</p> <p>45-59µg/dL, in 48 hours</p> <p>60-69µg/dL, in 24 hours</p> <p>≥70µg/dL, Immediately, as an emergency lab test</p> |

of lead exposure, and a referral to the local health department. While individual physicians may have the knowledge to provide information on lead hazards and lead hazard reduction, the LHD is able to observe the child within his/her environment. Education should be reinforced during follow-up visits, as needed.

Local health departments may also wish to supply local clinic settings with physician and patient education materials. Camera ready copies of materials developed by WCLPPP are available by contacting our office (608) 266-5817 or by completing the form at the end of Chapter 6. Available items include the “Look Out For Lead Parent Brochure” in Spanish and Hmong; the “4 Easy Questions” in Spanish and English; posters on lead hazards in English and Spanish; a poster of a quilt made by the Hmong American Friendship Association telling the story of lead poisoning in Milwaukee; and a poster describing the role of nutrition in decreasing the impact of lead poisoning. Framing these posters is often a welcome “gift” when visiting a clinic site to familiarize staff on lead poisoning and screening practices.

Provide Diagnostic and Follow-up Testing

All diagnostic and follow-up tests must be venous blood samples to assure accuracy, and to best evaluate the effectiveness of interventions. It is often after an elevated capillary screening test that the child is referred to the physician for a venous diagnostic test. This may be the first contact the physician has with the child and family, or it may be the first encounter with a well-known patient focused on a diagnosis of lead poisoning.

A diagnosis of lead poisoning is made based on a venous blood test. If a child has a capillary test $\geq 10\mu\text{g/dL}$, a diagnostic venous blood test should be obtained (see Figure 10.2).

Once lead poisoning is diagnosed, follow-up venous tests are required to monitor the child's blood lead level. Regular measurement of the BLL of a child with an elevated diagnostic test result is important because the BLL may continue to rise if the child continues to ingest lead.. Rising BLLs are especially likely in children 6 months to 2 years of age because this is the age group in which mouthing behavior is most frequent. The frequency and timing of follow-up tests depends on the diagnostic blood lead level, and whether chelation is implemented (see Figure 10.3)

Figure 10.3 Schedule for Follow-Up Blood Lead Testing

| Venous Blood Lead Level ($\mu\text{g/dL}$) | Early Follow-UP (first 3-4 months after identification) | Late Follow-up (after BLL begins to decline) |
|--|---|--|
| 10-14 | 3 months | 6-9 months |
| 15-19 | 1-3 months | 3-6 months |
| 20-24 | 1-3 months | 1-3 months |
| 25-44 | 2 weeks - 1 month | 1 month |
| ≥ 45 | Chelation with subsequent follow-up | Chelation with subsequent follow-up |

Source: Managing Elevated Blood Lead Levels Among Young Children, Center for Disease Control and Prevention, March, 2002

Clinical Assessment & Management of Children with Lead Poisoned

Clinical assessment management is part of comprehensive follow-up care provided to a child who is lead poisoned. Office visits for clinical management should be complemented by public health interventions including case management activities, visits to the child's home to provide education and assessment, lead hazard investigation, and control of lead hazards identified in the child's environment.

Figure 10.4 provides a summary of the components of clinical assessment. They are based on the experience of clinicians who have treated lead poisoned children, and should not be seen as rigid rules but as a guide for clinical decisions.

If the child has not seen a physician within the 6 months preceding the diagnosis of lead poisoning, the family should be advised to make an appointment with their health care provider for that purpose. The case manager should contact the physician with the blood lead test results, the reason that the physical exam has been recommended, and provide any information that the physician may need or request about childhood lead poisoning.

If the child does not have a consistent primary health care provider, the opportunity should be taken to connect them to a source of health care. This may require assistance in applying for Medicaid or BadgerCare, or identifying providers who will accept sliding scale payments. A source of ongoing medical care will be important in obtaining the follow-up venous blood lead tests, and for evaluation of the child's growth and development, especially as they approach school age.

Iron Deficiency and Lead Poisoning

Iron deficiency can enhance lead absorption and often co-exists with lead poisoning. In addition, research indicates that iron deficiency in young children can be an independent neurotoxin, as well as enhancing the effects of lead poisoning on the central nervous system.

Adequate iron intake lowers lead absorption, and should be considered a primary tool in decreasing the effects of exposure to lead hazards. While the effect of lead on red blood cell production rarely occurs until BLLs reach around 40µg/dL, low iron stores promote absorption of lead at any blood lead level. Over half of US children 1-2 years of age have daily iron intake below recommended amounts. When exposed to lead hazards, these children may see the lasting effects on cognitive development due to both iron deficiency in infancy and the long lasting negative effects due to lead.

All children with BLLs $\geq 10\mu\text{g/dL}$ should be evaluated for iron deficiency. Serum iron and iron binding capacity are the tests of choice, as they are the most sensitive indicators of iron status. If iron deficiency is diagnosed, treatment should begin along with treatment of the lead exposure. *Note: Children receiving BAL (dimercaprol) as a chelating agent should not be treated for iron deficiency until the drug therapy is completed.* For more information on nutritional status and lead poisoning, see Chapter 11.

Figure 10.4 Components of Clinical Assessment

| Component | Content | Action Steps |
|-----------------------|--|---|
| Medical History | Ask about: <ul style="list-style-type: none">• Symptoms (most children with lead poisoning are asymptomatic)• Developmental history• Mouthing activities• Pica Behaviors• Previous BLL measurements• Family history of lead poisoning | If there are delays or lags in developmental progress, the child should receive a thorough be referred to an early intervention program for further assessment |
| Environmental History | Ask about: <ul style="list-style-type: none">• The age, condition and how long they have lived at the primary residence• Remodeling, renovation, or repainting within the last year in the home.• Ask the same questions about other places the child spends time (including secondary homes and daycare) or previous residences.• Occupational and hobby histories of adults with whom the child spends time.• Use of imported dishes, cosmetics, toys, medicines• Additional questions about local environmental risk factors may be provided by the LHD. | Refer to the LHD for further assessment, environmental investigation, and lead hazard reduction |
| Nutritional History | Ask about: <ul style="list-style-type: none">• Usual foods eaten and eating patterns• Use of food stamps or WIC participation• Evaluate the child's iron status using appropriate laboratory tests | Provide treatment for iron deficiency if diagnosed Refer for nutritional counseling Refer to WIC if income eligible |
| Physical Examination | Pay particular attention to the neurologic examination, and to the child's psychosocial and language development | Findings of any delay in language, neurobehavioral or cognitive problems should result in referral to appropriate programs. During early school years, further examinations are necessary to facilitate entry into appropriate educational programs. |

Source: Adapted from Screening Young Children for Lead Poisoning, Center for Disease Control and Prevention, 1997

Evaluate Pica

Pica is “the persistent eating of nonnutritive substances for a period of at least one month, without an association with an aversion to food” (The Diagnostic and Statistical Manual of Mental Disorder: DSM-IV). Pica is most often observed in pregnant women, patients in lower socioeconomic status, and children. It has been associated with iron-deficiency anemia, but it is often unclear if the pica is the cause or the effect of the anemia. There is a wide range of items associated with pica, including chalk, newsprint, pencil erasers, baking soda, coffee grounds, and paint chips.

In children, a common problem associated with pica is lead poisoning, the result of eating lead-based paint chips or lead contaminated soil surrounding a home with deteriorating paint. If the pica is associated with iron-deficiency anemia, that can further exacerbate lead toxicity.

Parents are likely to underreport pica behavior because of embarrassment, or they may not be aware that the behavior is worth reporting. Pica is more often discovered when a complication, such as lead poisoning, is diagnosed and careful questioning follows about eating habits. An open discussion with the family about favorite foods and nonfood substances might aid in the diagnosis. If pica is suspected, but parents are unaware of the behavior, physicians should ask that a log be kept of observations of the child's solitary play.

Chelation Therapy

The most important treatment for lead poisoning is to eliminate the source of exposure – the lead hazard. However, when blood lead levels reach a certain point, the addition of chelating agents to pull the metal from the blood, may shorten the length of time a child is at risk for the negative health and learning effects of lead. Children receiving chelation therapy for treatment of lead poisoning require special care and consideration by the health care team. The current CDC recommendation is that chelation therapy be administered to children with blood lead levels $\geq 45\mu\text{g/dL}$. Results of research about the administration of oral chelators at lower blood lead levels were inconclusive. The most comprehensive information on this topic are results of a multi-center study called the TLC Study. (<http://www.niehs.nih.gov/oc/news/tlc.htm>)

The experience of physicians with chelating drugs for lead poisoning is varied, and will depend on the site of their clinical practice and the amount of exposure it provides to clients with lead poisoning. It is important that children being chelated are being treated according to drug treatment and medical management protocols that are consistent with established standards and recommendations. Public health nurses should be in communication with the child's physician regularly, to discuss the plan of care, follow-up, and to assure that the child is in a lead-safe environment if receiving chelation. If the physicians appears to need further information on treatment, a referral to Dr. Margaret Layde, Downtown Medical Center, (414) 277-8900, Milwaukee may be appropriate. The American Academy of Pediatrics Committee on Drugs wrote “*Treatment Guidelines for Lead Exposure in Children*”, which contains a good summary of chelation with the most commonly used agents (<http://www.aap.org/policy/00868.html>)

When To Start Chelation Therapy

As noted above, a child with a BLL $\geq 45\mu\text{g/dL}$ should be treated promptly with appropriate chelating agents and removed from the sources of lead exposure. If the BLL is $< 70\mu\text{g/dL}$, a second venous BLL should be drawn before initiating chelation to assure that therapy is based on the most recent and reliable information possible. If the BLL is $\geq 70\mu\text{g/dL}$, chelation therapy should be initiated immediately while the second venous BLL is pending.

The Child's Environment During Chelation

All the skills and leverage that Public Health professionals have should be used to assure that the child is protected from lead exposure during chelation. This is because lead is more readily absorbed by the body when chelating agents are administered. The initiation of outpatient chelation may need to be delayed until a lead-safe environment can be found. If the child received chelation as a hospital patient, discharge may need to be held until the child's home or destination is lead-safe. The family may need assistance in getting lead hazard reduction done effectively, or that an alternative environment, even if temporary, is found.

Information For the Family

In addition to all of the other information that the family is receiving about this diagnosis, there is more yet to be communicated about chelation therapy:

- ✓ The need and importance of a lead-safe environment during and after chelation. It is often difficult for families to secure a lead-safe place at the same time the child is hospitalized, or started on a new medicine. However, it is one of the most important tasks for them to undertake during this time.
- ✓ The name of the drug, dose, route of administration, schedule, and side effects of the chelating agent being used.
- ✓ The importance of follow-up testing (see below)
- ✓ The need for long-term monitoring of behavior and learning to determine if support is needed.

Blood Lead Tests After Chelation

Post-chelation venous retests are obtained in accordance with the drug protocols and child and family situation. Within days of chelation, the BLL may rebound to higher level. This is due to lead leaving the bone and entering the blood as the chelation lowers the BLL. This may require further treatment. The erythrocyte protoporphyrin tests can be used to differentiate between rebound and re-exposure to lead (see Chapter 6). The LHD should request that EPs be drawn with all follow-up blood lead tests, and provide the physician with information on the usefulness and interpretation of EP test results.

Assure Follow-Up

Short Term Follow-up Needs

Children with lead poisoning require comprehensive services because of the range of needs that a diagnosis of lead poisoning presents. This is best accomplished using by a team of professionals, including the health care provider, case manager, public health

nurse, environmental specialist, social services liaison, and housing specialist. Case management, lead hazard investigation, and relocating to safe housing are typically provided or coordinated by the health department.

Because childhood lead exposure is likely to be associated with residence in a poor and deteriorating neighborhood, children with elevated BLLs may also be facing other problems in their lives such as inadequate housing, lack of routine medical care, poor nutrition, and instability. Children with lead poisoning may also need educational support, and a follow-up team can facilitate early intervention and identification of services for which they may be eligible.

It is public health staff that typically coordinate the follow-up care provided. It becomes the responsibility of public health to assure that the health care provider is at the table for these discussions, is kept informed of public health services, and who in turn provides the information needed by the rest of the follow-up team.

Long Term Follow-up Needs

Research involving school performance and development of social skills among children with lead poisoning indicates difficulties in these areas are more common among children with a history of lead poisoning. Both prospective and retrospective studies have been consistent in findings that it is more common to find an association between a child's previous blood lead level and their current neurodevelopmental status than it is to see an association between a current elevated blood lead level and neurodevelopmental changes.

It is important to make long term surveillance of the neurodevelopment of a child with lead poisoning part of the child's ongoing medical care. This can be challenging, depending on the consistency of the child's source of medical care. Public health involvement routinely stops when the child's blood lead level drops and the source of lead hazards have been eliminated. However, public health professionals can play a key role in assuring that the family and the primary health care provider have the information they need to assure that the developmental status of the child is evaluated on an ongoing basis in light of the diagnosis of lead poisoning.

Developmental surveillance is important so that the child is successful at critical learning periods in his/her development. These critical learning periods are:

- 1st grade: basic learning skills are being acquired that form the building blocks for future learning.
- 4th grade: the basic learning skills are now applied to new learning
- 6-7th grade: higher order learning is happening, involving planning and organizational skills.

Research on the affects of lead has shown that increased BLLs are associated with difficulties in the attainment of all of these skills. Children most at risk for lead poisoning are often most at risk of being left behind in school and achievement. The long-term costs to the community, the children and their families are significant.

Health care providers can support this long-term surveillance activity by placing a history of lead poisoning in the child medical record or medical diagnosis/problem list and in assuring that it is included in any referral to another health care provider that the child sees.

Collaborate With the Health Department

Smooth and effective interactions between private health care providers and public health will lead to the most effective treatment of a child with lead poisoning. These interactions begin with communication about the results of screening and follow-up tests, physical examinations related to lead poisoning, developmental assessments, nutrition assessments, environmental interventions, education provided and referrals made.

Both the child and the family benefit from efforts made on the part of public health and the medical field in complementing each other's treatment practices.

REFERENCES

Adams, William G., Judith Greva, Jerry Coffman, Sean Palfrey, and Howard Bauchner, *"Anemia and Elevated Lead Levels in Underimmunized Inner-city Children"*, Pediatrics, Vol 101, No. 3, March 1998.

American Academy of Pediatrics, *"Statement on Childhood Lead Poisoning"*, Committee on Environmental Hazards, Committee on Accident and Poison Prevention, Pediatrics, 1987.

American Academy of Pediatrics, *"Lead Poisoning: From Screening to Primary Prevention"*, Committee on Environmental Health, Pediatrics, 1993.
(<http://www.aap.org/policy/re9307.html>)

American Academy of Pediatrics, *"Treatment Guidelines for Lead Exposure in Children"*, Committee on Drugs, Pediatrics, Vol 96, No1, July 1995.
(<http://www.aap.org/policy/00868.html>)

American Academy of Pediatrics, *"Screening for Elevated Blood Lead Levels"*, Committee on Environmental Health, Pediatrics, Vol 101, No 6, June 1998.
(<http://www.aap.org/policy/re9815.html>)

Binns, Helen J., MD, MPH, *"Lead Poisoning: Still a Common Problem in Chicago"*, The Child's Doctor, Journal of the Children's Memorial Hospital, Chicago, Spring, 2001
(www.childsdoc.org/spring2001/leadpoisoning.asp)

Center for Disease Control and Prevention, *"Managing Elevated Blood Lead Levels Among Children"*, March, 2002.

Lanphear, Bruce, Dietrich, K., Auinger, P., Cox, C, "*Cognitive Deficits Associated With Blood Lead Concentrations <10 μ g/dL in US Children and Adolescents*", Public Health Reports, Vol. 115, November/December 2000

Rose, Edward A., MD, John H. Porcerelli, PhD, Anne Victoria Neale, PhD, "*Pica: Common but Commonly Missed*", Journal of American Board of Family Practitioners, 13(5):353-358, 2000.

Revised 10/9/2003